Fisheries and Oceans Science | Pêches et Océans Sciences

C S A S | **S C C S**

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Research Document 2001/145 | **Document de recherche 2001/145**

Not to be cited without permission of the authors [1]

Ne pas citer sans Autorisation des auteurs [1]

Redfish Catch Results from Summer 2001 Survey in Unit 2

Résultats du relevé du sébaste effectué à l'été 2001 dans l'unité de gestion 2

John McClintock

AMEC
95 Bonaventure Avenue, P.O. Box 2035
St. John's, NF, A1C 5R6

[1] This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

[1] La présente série documente les bases scientifiques des évaluations des ressources halieutiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Research documents are produced in the official language in which they are provided to the Secretariat.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au Secrétariat.

ISSN 1480-4883
Ottawa, 2001

Canada

102-06446/

Abstract

To enhance the fisheries research database in Unit 2, NAFO Divisions 3Pn, 3Ps, 4Vn, and 4Vs, the Groundfish Enterprise Allocation Council (GEAC) has funded redfish surveys during winter 1997, and summer 1998, 1999, 2000, and 2001. The continuing intent is to maintain a series of annual summer surveys to complement current resource assessment activities carried out by the Department of Fisheries and Oceans (DFO). GEAC funded and performed the surveys with scientific guidance from DFO in the design and execution of a stratified random survey and the associated sampling. The data collected during these surveys have been subsequently analysed on behalf of GEAC and for the additional intent of providing this information to DFO, for their databases and their assessment work. This is the fifth such GEAC redfish survey in Unit 2 following on the previous 1997 to 2000 surveys. Catch statistics, length distribution, and stratified analysis estimates of redfish abundance and biomass, and interpretation of results are presented. The Unit 2 biomass estimate is 141 ktonnes compared with the 1997 to 2000 values of 240, 222, 94, and 169 ktonnes respectively. Conversely, the 2001 abundance estimate of 404 million is increased from 2000 and 1999 values of 318 million and 182 million respectively, and down slightly from the 1997 and 1998 estimates of 486 million and 497 million. This would suggest that there is a greater estimate of smaller fish and a lesser estimate of larger fish. Overall, some level of stability can be inferred for the past five years with some additional presence of the smaller fish detected. Continued annual surveys are required to monitor the stock status. While still present, the 1980 year-class appears to be less prevalent compared with previous years. The 1988 year-class remains absent from 3Pn and 4Vn, is at comparable (low) levels in 3Ps, and is up dramatically from 2000 in 4Vs where values are quite similar to those seen in 1998. Certainly in 4Vs it appears that the 1988 year class is gradually replacing the 1980 year class in the adult population. The 1994 year-class first seen in 3Pn in 1998 and again in 2000 in 3Pn and to a degree in 4Vn is now evident in all divisions, although the numbers in 4Vn are quite small. The greatest increases are seen in 3Pn and 4Vs. The greatest concentrations of redfish continue to be along the southeastern slopes of the continental shelf. The numbers of fish within the Laurentian Channel and slopes appear to be less in 2001, particularly along the western portions. Distributions northwest of St. Pierre Bank in 3Ps appear generally consistent through all years. Depth and oceanographic conditions may be factors associated with these aggregations.

Résumé

Pour améliorer la base de données de recherche sur les pêches pour l'unité de gestion 2 (sous-divisions 3Pn, 3Ps, 4Vn et 4Vs de l'OPANO), le Conseil des allocations aux entreprises d'exploitation du poisson de fond (GEAC) a financé des relevés du sébaste effectués à l'hiver 1997 et aux étés 1998, 1999, 2000 et 2001. Ces travaux ont pour but d'obtenir une série de relevés annuels d'été afin de compléter les activités d'évaluation des ressources que mène actuellement le ministère des Pêches et Océans (MPO). Le GEAC a financé et réalisé les relevés avec l'aide du MPO, qui a fourni des conseils scientifiques pour la conception et la réalisation d'un relevé aléatoire stratifié et des échantillonnages connexes. Les données ainsi recueillies ont été analysées pour le compte du GEAC et en vue de les transmettre au MPO pour les bases de données et dans les travaux d'évaluation. Ce document aborde le cinquième relevé annuel du sébaste dans l'unité de gestion 2, lequel donne suite aux relevés effectués de 1997 à 2000. Le document présente des statistiques de capture, la distribution des longueurs, des estimations par analyse stratifiée de l'abondance et de la biomasse du sébaste ainsi que l'interprétation des résultats. La biomasse estimée pour l'unité de gestion 2 est de 141 kilotonnes, alors qu'elle se chiffrait à 240, 222, 94 et 169 kilotonnes respectivement en 1997, 1998, 1999 et 2000. Pour ce qui est de l'abondance, l'estimation de 404 millions de poissons en 2001 est en hausse par rapport aux valeurs de 2000 (318 millions) et de 1999 (182 millions), mais légèrement inférieure aux estimations de 1997 (486 millions) et de 1998 (497 millions). Cela indiquerait plus de petits poissons et moins de gros poissons. Globalement, on peut déduire que les cinq dernières années présentent un certain niveau de stabilité, avec une présence accrue de poissons de petite taille. Il faut poursuivre les relevés annuels afin de surveiller l'état du stock. Quoique toujours présente, la classe d'âge de 1980 semble moins dominante que lors des années antérieures. La classe d'âge de 1988 est toujours absente de 3Pn et 4Vn; l'effectif de cette classe d'âge est toujours faible dans 3Ps, tandis que, dans 4Vs, il a augmenté de façon spectaculaire par rapport à 2000, pour atteindre des valeurs semblables à celles de 1998. Dans la sous-division 4Vs, la classe d'âge de 1988 semble remplacer graduellement celle de 1980 dans la population adulte. La classe d'âge de 1994, observée pour la première fois dans 3Pn en 1998, puis de nouveau en 2000 dans 3Pn et, dans une certaine mesure, dans 4Vn, est maintenant présente dans toutes les sous-divisions, bien que son abondance soit très faible dans 4Vn. Les plus fortes hausses sont observées dans 3Pn et 4Vs. Les plus grandes concentrations de sébastes se trouvent toujours le long des pentes sud-est de la plate-forme continentale. Leur abondance dans le chenal Laurentien et le long de ses pentes semble moins élevée en 2001, en particulier dans la partie occidentale de ce secteur. Dans 3Ps, les répartitions des sébastes au nord-ouest du banc Saint-Pierre semblent généralement constantes d'une année à l'autre. La profondeur et les conditions océaniques pourraient être des facteurs liés à ces concentrations.

Introduction

To enhance the fisheries research database in Unit 2, NAFO Divisions 3Pn, 3Ps, 4Vn, and 4Vs, the Groundfish Enterprise Allocation Council (GEAC) has funded redfish surveys during winter 1997, and summer 1998, 1999, 2000, and 2001. The continuing intent is to maintain a series of annual summer surveys to complement current resource assessment activities carried out by the Department of Fisheries and Oceans (DFO). GEAC funded and performed the surveys with scientific guidance from DFO in the design and execution of a stratified random survey and the associated sampling. The data collected during these surveys have been subsequently analysed on behalf of GEAC and for the additional intent of providing this information to DFO, for their databases and their assessment work. This is the fourth such GEAC redfish survey in Unit 2 following on the previous 1997 to 1999 (CSAS Research Document 99/155 [1]) and 2000 (CSAS Research Document 2000/133 [2]) surveys. Under contract to GEAC, AMEC has taken the set catch and length frequencies data logged using the DFO FFS system, and performed a first analysis of the survey results. This document presents these results.

Methods and Materials

A Stratified Random survey was carried out in Unit 2 by the *M.V. Cape Ballard*. A summary of the trip is presented below.

Trip 2: Stratified Random Survey
Trip 2 was carried out from 10-18 September 2001. These dates generally match earlier dates of 31 August to 9 September in 1999, 16-23 August in 1998, and 15-23 August in the 2000 survey. The 1997 survey was carried out from 1-12 December. The *Cape Ballard*, was also used in the 1998 survey. The *M.V. Cape Beaver,* a ship of comparable size and design, performed the 1997, 1999, and 2000 surveys. During the trip, length sampling was carried out on board, and the set details and length frequencies data were logged onboard in the DFO FFS system.

Tows of duration 30 minutes were conducted at a speed of 3.5 knots using a commercial Engel 170' bottom trawl with a 105-110 mm lined cod end. Performance of the trawl was checked onboard using the NETMIND system. The trawl gear and configuration were identical to those used in the earlier years with the exception that the 1997 to 1999 surveys did not use a liner.

A total of 93 successful stratified random tow sets were completed. Two sets were unsuccessful.

Results and Discussion

The set details and redfish length frequencies were exported from FFS to create ASCII digital data files.

ACON plots of the 2001 spatial distribution of catch weights are presented in Figure 1 together with results from the 1997 to 2000 surveys. Figure 1a shows a map illustrating the location of the strata surveyed. Table 1 presents a summary of the redfish set details and catch numbers and weights.

Nearly all sets were 30 minutes duration. Two sets 50 and 51 had durations of 15 minutes, while set 12 was 43 minutes. The catches for all sets were adjusted to a standard 30 minute tow in the presentation of Table 1 and Figure 1 results and also in the stratified analysis (see below). The redfish were sampled in 1 cm length groupings and all ratio/percentages of catch measured were applied.

The mean redfish catch for the 93 successful stratified random sets is 650 fish and the mean catch weight is 207 kg. The corresponding values in 2000 were 553 redfish and 256 kg. The median catch for all sets was 176 fish compared with 182 in 2000. The median catch weight was 70 kg in 2001 compared to 96 kg in 2000. So while the "middle" set catches of the distribution appear comparable in terms of numbers of fish the weights are less.

In 2000, there were seven large sets greater than 900 kg, five in 4Vs (including the three largest sets) along the deep slopes of the continental shelf and located along the western deep slope sides of the Laurentian Channel, one in 3Ps just south of 45°N, and one in the southeast corner of 4Vn just south of 46°N. In 2001, three sets were greater than 900 kg, all in 4Vs and located in the same deep slopes of the continental shelf at the south.

Stratified Random surveys analysis was carried out using the DFO stratified analysis STRAP software and applying the French Exclusion Zone around St. Pierre et Miquelon for area calculations. A wingspread of 69 feet was used, consistent with the 1997-2000 analyses.

Table 2 presents mean weight per set and biomass estimates. Observations to make include:

- Overall, in Unit 2, the total biomass estimate for 2001 is 141 ktonnes, down 16% from the 2000 estimate of 169 ktonnes, still greater than the 1999 estimate of 94 ktonnes, and down approximately one third from the 1997 and 1998 estimates of 240 and 222 ktonnes respectively. Conversely, the total abundance in 2001 is 404 million, up 27% from 2000. The overall Unit 2 mean weight per set is 203 kg.

- In 3Pn, the biomass estimate of 4.8 ktonnes, which represents 3% of the total Unit 2 biomass, is down 24% from 2000, 56% from 1999, 46% from 1998, and 36% from 1997. The overall 3Pn mean weight per set is 69 kg, a decrease of about one third from the values of 90 kg and 108 kg per tow in

2000 and 1997 respectively, and generally less than half of the 127 kg, and 158 kg values in 1998 and 1999.

- In 3Ps, the biomass estimate of 34.9 ktonnes, which represents 25% of the total Unit 2 biomass, is 8% less than for 2000, and down by 13%, 31%, and 67% from the prior years 1999, 1998, and 1997 respectively. The overall 3Ps mean weight per set is 118 kg and is down from the preceding four years by similar proportions that the biomass is reduced. As in 2000, the range of mean weights, (95% upper and lower values) 72 to 163 kg, is noticeably more tightly distributed though than for the earlier years.

- In 4Vn, the biomass estimate of 15.9 ktonnes, which represents 11% of the total Unit 2 biomass, is down by half from 2000, down by 32% from 1999, and down 75-79% from the 1997 and 1998 estimates. The 4Vn mean weight per tow is 82 kg, also down by half from 2000.

- In 4Vs, the biomass estimate is 85.6 ktonnes for 2001, which represents 60% of the total Unit 2 biomass. This estimate is comparable (7% lower) to the 2000 value of 92.0 ktonnes, more than four times the 1999 estimate, again comparable to the 1998 value, and about 25% greater than the 1997 estimate. The mean weight per set for 4Vs is 644 kg, with broad upper and lower limits.

- Aside from 1999, which also had the lowest biomass estimate of the five years, the greatest proportion of the Unit 2 biomass is present in 4Vs, and this proportion has increased in 2001 from that in 2000. Geographically, there appears to be a continued trend towards greater numbers of fish towards the south. In 2000, 54% of the Unit 2 biomass was located in division 4Vs. As already noted, this proportion increased to 60% in 2001. Conversely, for 4Vn to the north and towards Cabot Strait and the Gulf of St. Lawrence, in 2000, 19% of the Unit 2 biomass was located there, compared with 11% in 2001. While there is a slight trend downwards, there appears to be somewhat more consistency in the biomass estimates in 3Ps. Those estimates represent approximately 44% in 1997 and 1999, and 22-25% for the other three years.

Figure 2 presents the redfish survey abundance index at length values, by sex, for the 1997-2001 Unit 2 surveys. The 2001 distribution shapes are similar to those for 2000 in that a similar range of lengths is seen with the addition of a number of smaller fish (unsexed) in the 10-11 cm range which were caught in 3Ps and 3Pn. The overall abundance or area under the curves are comparable. One can note that there is a reduction in the 1980 year class (31-36 cm range) and a large increase in the 1988 year class for males in the 25-27 cm range and for females in the 28-31 cm range. Consistent with 2000, a third mode at 18-20 cm is also evident and increased for both sexes. Consistent with the previous years, female sizes appear to be 2-4 cm larger than for their male counterparts for a given year class grouping.

Figure 4 presents the male and female abundance distributions for all five years together. For both sexes in 2001, the decreasing trend of the 1980 year class continues. There is also an increase in the abundance of the 1988 year class, most

noticeably for males, certainly compared to 2000 and 1999. The 1994 year class which was more pronounced in the females in 2000, is now more evident as well in the males.

For males, the peak for the 1980 year class group which had increased by about 1 cm per year, from 31 cm in 1997 to 32 cm in 1998 and 1999 and to 33 cm in 2000, is located at 32 cm again in 2001, and at the lowest peak value of the five years. The 1988 year class group peaks have increased from 24 cm in 1997 to 25 cm in 1998 and have remained at 26 cm for 1999, 2000, and 2001. For the 1994 year class, the peak in 2001 is located at 21 cm, compared with 20 cm in 2000.

For females, the 1994 year class is present at lengths 18-20 cm. The peak of this mode is at 19 cm in 2000 and 21 cm in 2001. The peaks for the 1980 year class group have increased by about 1 cm per year, from 33 cm in 1997 to 34 cm in 1998, to 33 cm in 1999, 35 cm in 2000, and up to 36 cm in 2001, but again noting that the magnitude of this year class peak in 2001 is the lowest of the five years. The 1988 year class group peaks have stayed at around 27 cm for 1997 to 1999 and are at 30 cm for 2000 and 2001.

Figure 3 presents the length distributions for each division for all five years of the GEAC surveys. The mean number per standard tow is presented. Figure 5 presents the same information, arranged with all years together in a graph for each division.

In 3Pn, in 2001, there is an absence of fish in the 22-33 cm range corresponding to the 1988 year class and it appears part of the 1980 year class as well. Consistent with the 1998 and 2000 surveys, the 1994 year class is again apparent this time at greater numbers. A number of unsexed fish 15 cm and smaller were caught. There is now some presence of fish in the 35 to 45 cm range. One must note that the magnitudes of the catches in 3Pn are in general much smaller than for the other three divisions.

In 3Ps, all three year classes are evident, at values comparable to 2000, and increased for the 1994 year class, though none of the three peaks are particularly well-defined.

In 4Vn, the 1980 year class is present in the 32-37 cm range down from all previous years. As for 3Pn, there is almost a total absence of fish in the 22-27 cm range corresponding to the 1988 year class. There is a very small presence it appears of the 1994 year class in the 18-20 cm range, although a small fraction of the values seen in 2000.

In 4Vs, the 1980 year class is evident in the 34-36 cm range although this largely appears as the high end of the 1988 year class peak which itself is at the same high levels seen in 1997. A small peak indicative of the 1994 year class is now evident at 18 cm.

Summary

The following summary observations can be made:

- The 2001 Unit 2 biomass estimate of 141 ktonnes is down slightly from the 2000 estimate of 169 ktonnes, and lies somewhere in between the 1997 to 1999 estimates of 240, 222, and 94. A net liner was used in 2000 and 2001. The additional redfish seen at the smaller lengths of 20 cm and under amount to 12% of the total abundance estimate in 2001, compared with 6% in 2000. By comparison, very small amounts of about 1% or less of the fish caught in 1997 to 1999 are less than 20 cm, consistent with the absence of a liner. Overall, some level of stability can be inferred for the past five years with some additional presence of the smaller fish detected. Continued annual surveys are required to monitor the stock status.

- While still present, the 1980 year-class appears to be less prevalent compared with previous years. Numbers are down in all divisions, not quite as much in 3Ps. In 4Vs the numbers are reduced and there is much less of a distinct peak at lengths in the 31-36 cm range corresponding to the 1980 year class.

- The 1988 year-class, in the 25-27 cm length range, remains absent from 3Pn and 4Vn, is at comparable (low) levels in 3Ps, and is up dramatically from 2000 in 4Vs where values are quite similar to those seen in 1998. Certainly in 4Vs it appears that the 1988 year class is gradually replacing the 1980 year class in the adult population.

- The 1994 year-class first seen in 3Pn in 1998 and again in 2000 in 3Pn and to a degree in 4Vn is now evident in all divisions, although the numbers in 4Vn are quite small. The greatest increases are seen in 3Pn and 4Vs. As noted above, the 2000 and 2001 surveys used a liner whereas the previous three years did not so that with this element of selectivity the surveys are not comparable in this one regard.

- The greatest concentrations of redfish continue to be along the southeastern slopes of the continental shelf. The numbers of fish within the Laurentian Channel and slopes appear to be less in 2001, particularly along the western portions. Distributions northwest of St. Pierre Bank in 3Ps appear generally consistent through all years. Depth and oceanographic conditions may be factors associated with these aggregations.

References

[1] Power, D., 1999. "The Status of Redfish in Unit 2." CSAS Research Document 99/155."

[2] McClintock, J., 2000. "Redfish Catch Results from Summer 2000 Survey in Unit 2." CSAS Research Document 2000/133."

Table 1 Summary of Redfish Catches for Stratified Random Survey Sets, Unit 2, 10-18 September 2001

Cape Ballard (vessel code 48) Trip 2

Set	Day	StrLin	Division	Unit Area	Set Location Lat (N)	Set Location Long (W)	Redfish Catch ** # of Fish	Redfish Catch ** Weight (kg)	Set Duration (min)	Tow Distance (n.mi.)	Redfish Mean Weight (kg)
1	10	398	4V	L33	44.91	56.86	377	202	30	1.7	0.54
2	10	399	4V	K32	45.03	57.18	183	118	30	1.7	0.64
4	10	398	4V	K32	45.08	57.08	220	135	30	1.7	0.61
5	10	398	4V	K32	45.12	57.13	132	81	30	1.7	0.61
6	10	397	4V	K31	45.76	57.02	70	43	32	1.7	0.61
7	11	397	4V	K32	45.24	57.06	214	121	32	1.7	0.57
8	11	397	4V	K32	45.27	57.31	68	40	32	1.7	0.59
9	11	400	4V	K32	45.32	57.45	82	49	32	1.7	0.60
10	11	446	4V	K32	45.17	57.53	49	28	30	1.7	0.57
11	11	400	4V	K32	45.38	57.69	108	64	30	1.7	0.59
12	11	446	4V	J31	45.74	58.06	501	213	43	1.7	0.43
13	11	415	4U	K25	45.76	57.79	140	83	32	1.7	0.59
14	11	415	4U	K31	45.92	57.75	120	71	32	1.0	0.59
15	11	415	4U	K31	45.95	57.99	143	85	30	1.7	0.59
16	11	415	4U	J30	46.00	58.10	218	122	30	1.7	0.56
17	11	415	4U	J30	46.07	58.20	201	141	30	1.7	0.70
18	11	415	4U	K30	46.09	57.97	157	94	30	1.7	0.60
19	12	415	4U	J30	46.22	58.43	91	57	31	1.7	0.63
20	12	417	4U	J30	46.22	58.88	135	50	31	1.7	0.37
21	12	417	4U	H29	46.52	59.33	178	110	30	1.7	0.62
22	12	415	4U	J30	46.38	58.73	159	86	30	1.7	0.54
23	12	416	4U	J30	46.37	58.97	72	45	30	1.7	0.63
24	12	415	4U	J29	46.50	58.95	99	62	30	1.7	0.63
25	12	416	4U	H29	46.57	59.23	793	353	30	1.7	0.45
26	12	416	4U	H29	46.81	59.66	120	67	30	1.7	0.56
27	13	415	4U	H29	46.87	59.01	27	18	32	1.7	0.66
28	13	415	4U	H28	47.05	59.25	14	8	32	1.0	0.60
29	13	415	4U	H28	47.06	59.54	18	11	32	1.0	0.63
30	13	416	4U	H28	47.10	59.97	59	44	30	1.7	0.75
31	13	415	4U	H28	47.22	59.92	48	33	30	1.7	0.69
32	13	415	4U	H28	47.29	59.73	21	13	30	1.7	0.62
33	13	415	4U	J28	47.48	58.61	13	9	30	1.7	0.69
35	13	305	3Q	H28	47.47	59.33	184	125	32	1.7	0.68
36	13	305	3Q	H28	47.34	59.36	72	48	33	1.7	0.67
37	13	304	3Q	J28	47.41	58.96	75	42	30	1.7	0.56
38	13	304	3Q	J28	47.38	58.87	19	10	30	1.7	0.53
39	13	305	3Q	H28	47.17	59.05	33	20	30	1.7	0.61
40	13	305	3Q	J29	46.96	58.76	50	28	30	1.7	0.56
41	14	303	3Q	J28	47.29	58.31	608	30	32	1.7	0.05
42	14	303	3Q	J28	47.38	58.12	558	184	30	1.7	0.33
43	14	303	3Q	J28	47.48	58.21	353	38	30	1.7	0.11
44	14	306	3P	K28	47.37	57.89	240	85	30	1.7	0.35
45	14	306	3P	J28	47.13	58.22	105	105	30	1.7	1.00
46	14	714	3P	J28	47.04	58.25	116	67	30	1.7	0.58
47	14	715	3P	K29	46.95	58.00	266	161	31	1.7	0.60
48	14	714	3P	J29	46.84	58.33	61	34	32	1.7	0.55
49	14	714	3P	J29	46.62	58.47	134	80	32	1.7	0.59
50	14	714	3P	J29	46.56	58.16	252	154	15	1.7	0.61
51	14	714	3P	J29	46.68	58.23	164	100	15	1.7	0.61
52	14	714	3P	W06	46.74	58.10	69	42	30	1.7	0.61
53	15	715	3P	K29	46.73	57.73	922	385	31	1.0	0.42
54	15	716	3P	K29	46.89	57.61	254	134	31	1.7	0.53
55	15	716	3P	K29	46.88	57.55	98	51	30	1.7	0.52
56	15	309	3P	K28	47.03	57.49	339	173	30	1.7	0.51
57	15	309	3P	K28	47.17	57.28	1101	299	30	1.7	0.27
58	15	716	3P	K28	47.04	57.12	419	265	31	1.7	0.63
59	15	310	3P	V29	46.89	57.17	358	69	30	1.7	0.19
60	15	310	3P	K29	46.72	57.44	89	12	30	1.7	0.13
61	15	313	3P	K29	46.64	57.45	194	26	30	1.7	0.13
62	15	705	3P	K29	46.63	57.58	25	6	30	1.7	0.24
63	15	713	3P	K30	46.50	57.72	15	7	30	1.7	0.47
64	15	713	3P	K30	46.31	57.48	36	20	30	1.7	0.56
65	16	313	3P	K30	46.10	57.13	454	51	30	1.7	0.11
66	16	705	3P	K30	46.06	57.19	83	27	32	1.7	0.33
67	16	713	3P	K30	46.06	57.39	118	70	32	1.7	0.60
68	16	713	3P	K30	46.01	57.43	74	41	30	1.7	0.55
69	16	713	3P	K31	45.95	57.55	100	61	30	1.7	0.61
70	16	712	3P	K31	45.67	57.40	240	150	30	1.7	0.63
71	16	712	3P	K31	45.64	57.25	192	116	30	1.7	0.60
72	16	712	3P	K31	45.81	57.13	213	129	32	1.7	0.61
73	16	706	3P	K31	45.91	57.01	319	171	31	1.7	0.54
74	16	316	3P	L31	45.90	56.90	672	101	25	1.7	0.15
75	16	712	3P	L31	45.58	56.96	93	47	30	1.7	0.51
76	16	711	3P	L32	45.13	56.61	107	54	30	1.7	0.50
77	16	711	3P	L32	45.14	56.53	121	62	30	1.7	0.51
78	17	706	3P	L32	45.16	56.37	767	85	31	1.7	0.11
79	17	316	3P	L32	45.05	56.21	206	41	30	1.7	0.20
80	16	706	3P	L33	44.92	56.26	322	74	31	1.7	0.23
81	17	711	3P	L33	44.83	56.24	1215	399	32	1.7	0.33
82	17	707	3P	M33	44.88	55.87	1201	136	30	1.7	0.11
83	17	708	3P	M33	44.92	55.61	337	60	30	1.7	0.18
84	17	707	3P	M33	44.96	55.58	1036	184	30	1.7	0.18
85	17	708	3P	M32	45.07	55.11	2627	685	29	1.7	0.26
86	17	318	3P	N32	45.07	54.68	339	65	31	1.7	0.19
87	17	318	3P	M33	44.96	55.60	223	22	30	1.7	0.10
88	17	398	4V	L33	44.64	56.58	176	68	30	1.7	0.39
89	18	398	4V	L33	44.59	56.70	515	358	32	1.0	0.70
90	18	399	4V	K33	44.53	57.01	17176	5435	32	1.7	0.32
91	18	399	4V	K33	44.53	57.09	3071	945	32	1.7	0.31
92	18	468	4V	K34	44.35	57.50	5923	1936	25	1.7	0.33
93	18	451	4V	K34	44.32	57.81	9238	1822	30	1.7	0.20
94	18	451	4V	J34	44.03	58.51	314	84	32	1.7	0.27
95	18	468	4V	J35	43.97	58.62	904	278	32	1.7	0.31
					Minimum		13.0	6.0	15.0	1.0	0.05
					Maximum		17175.9	5434.7	43.0	1.7	1.00
					Mean		649.6	206.6	30.3	1.7	0.48
					Median		176.0	70.3	30.0	1.7	0.56
					Standard Error		22.6	6.7	0.0	0.0	0.00
					Total		60413.8	19214.0	2819.0	154.6	44.19
					Count		93	93	93	93	93

*** set catch numbers and weights adjusted to a standard 30 minute tow at 3.5 knots*

Table 2 Mean weight (kg) of redfish caught per standard 30 minute tow and survey biomass in UNIT2 during GEAC surveys from 1997-2001. (Numbers in brackets are successful sets, "-" indicates strata not sampled). Total abundance estimates are noted at the bottom of the table.

STRATUM	Depth Range (m)	Area sq. n. mi.	1997 Dec 1-12	1998 Aug16-23	1999 Aug31-Sep9	2000 Aug15-23	2001 Sep10-18
3Pn							
303	185-274	554	187.8 (2)	651.2 (2)	271.4 (3)	50.9 (3)	89.65 (3)
304	275-366	151	194.2 (2)	49.8 (2)	36.3 (2)	388.5 (2)	27.53 (2)
305	367+	733	27.2 (2)	76.8 (2)	96.7 (4)	58.8 (4)	61.94 (4)
Upper			828.3	982.8	443.2	175.8	147.5
Mean			108.4	126.7	157.7	90.4	69.0
Lower			-611.6	-729.4	-127.8	5.0	-9.5
Biomass (metric tons)			**7630**	**8918**	**11100**	**6362**	**4858**
3Ps							
306	185-274	363	0.1 (2)	11.7 (2)	9.2 (2)	54.5 (2)	100.6 (2)
309	185-274	296	10.7 (2)	106.4 (2)	411.0 (2)	149.0 (2)	249.9 (2)
310	185-274	170	-	20.7 (2)	8.4 (2)	70.5 (2)	42.9 (2)
313	185-274	165	10.6 (2)	10.6 (2)	5.0 (2)	33.0 (2)	40.8 (2)
316	185-274	189	40.6 (2)	68.3 (2)	19.1 (2)	104.5 (2)	66.2 (2)
318	185-274	129	1697.5 (2)	-	173.6 (2)	71.0 (2)	47.1 (2)
705	275-366	195	105.8 (2)	29.1 (2)	32.5 (2)	56.6 (2)	18.5 (2)
706	275-366	476	-	97.4 (2)	58.3 (3)	49.3 (3)	120.4 (3)
707	275-366	74	707.3 (2)	931.2 (2)	202.0 (2)	373.5 (2)	169.4 (2)
715	275-366	128	204.3 (2)	397.1 (2)	249.5 (2)	108.0 (2)	446.1 (2)
716	275-366	539	-	195.4 (2)	88.1 (3)	80.0 (3)	163.4 (3)
708	367-549	126	1267.8 (2)	995.3 (2)	1906.5 (2)	1104.5 (2)	382.2 (2)
711	367-549	593	482.1 (2)	173.1 (2)	75.0 (3)	172.3 (3)	191.3 (3)
712	367-549	731	74.5 (3)	160.4 (2)	64.9 (4)	190.8 (4)	119.4 (4)
713	367-549	851	1285.5 (4)	31.1 (3)	123.1 (5)	113.6 (5)	43.2 (5)
714	367-549	1047	236.2 (3)	312.4 (3)	99.3 (6)	64.7 (6)	63.0 (6)
709	550-731	147	-	-	-	-	-
Upper			903.1	267.4	552.2	184.2	162.6
Mean			444.4	173.3	135.5	127.6	117.5
Lower			-14.2	79.2	-281.2	71.0	72.3
Biomass (metric tons)			**106329**	**50412**	**40273**	**37916**	**34919**
4Vn							
417	185-274	387	17.9 (2)	347.6 (2)	332.1 (2)	108.5 (2)	85.8 (2)
416	275-366	671	73.7 (2)	242.5 (2)	118.6 (4)	83.8 (4)	134.7 (4)
415	367-532	2915	416.7 (7)	347.6 (8)	92.5 (16)	195.5 (16)	68.9 (15)
Upper			1010.0	648.2	145.1	287.5	122.1
Mean			319.9	382.9	120.3	168.2	81.7
Lower			-370.2	117.6	95.4	48.9	41.2
Biomass (metric tons)			**62219**	**74474**	**23391**	**32714**	**15881**
4Vs							
446	185-366	313	32.4 (2)	3550.8 (2)	-	542.5 (2)	176.8 (2)
451	185-366	147	1995.7 (3)	-	-	56.0 (2)	1012.2 (2)
452	185-366	345	-	-	-	-	-
397	367-549	540	1403.5 (3)	279.0 (2)	106.2 (2)	1003.7 (3)	76.9 (3)
398	367-549	833	51.1 (4)	558.4 (3)	320.6 (3)	258.7 (6)	240.4 (6)
399	367-549	465	56.3 (3)	132.4 (2)	97.3 (2)	1378.5 (2)	2443.4 (2)
400	367-549	270	36.6 (2)	78.4 (2)	93.4 (2)	138.5 (2)	61.4 (2)
468	367-549	148	1077.6 (2)	-	-	1796.0 (2)	1011.2 (2)
Upper			828.8	6604.9	357.5	1924.1	2055.4
Mean			478.5	747.6	187.3	692.1	643.7
Lower			128.1	-5109.7	17.1	-540.0	-767.9
Biomass (metric tons)			**63619**	**88601**	**19329**	**92020**	**85593**
TOTAL GEAC SURVEY BIOMASS			**239797**	**222405**	**94093**	**169012**	**141251**
TOTAL ABUNDANCE (millions)			***486***	***497***	***182***	***318***	***404***

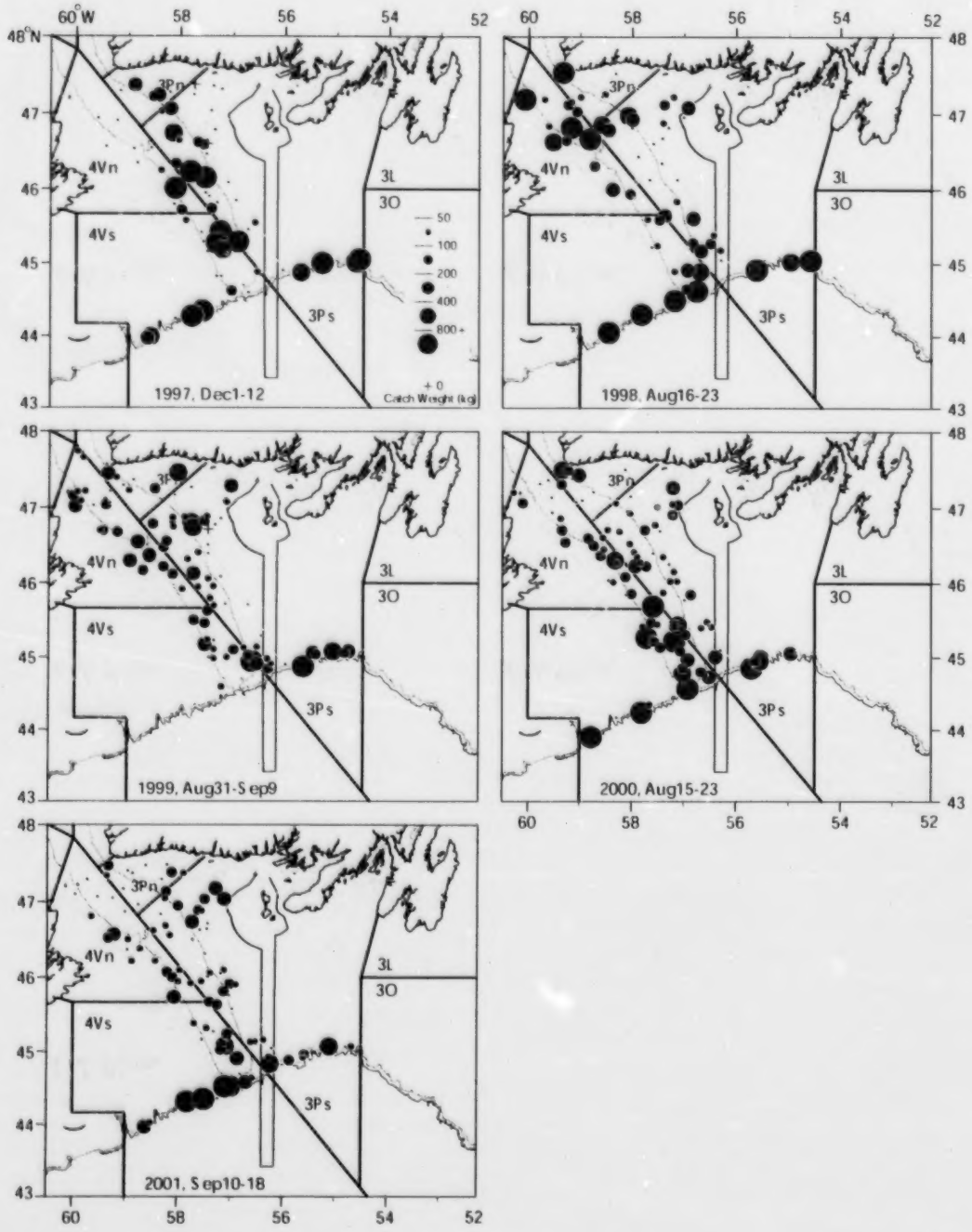


Figure 1 Redfish Catch Weight Distributions from GEAC Stratified Random Surveys, Unit 2, 1997-2001. 200, 400, and 800 m depth contours are shown.

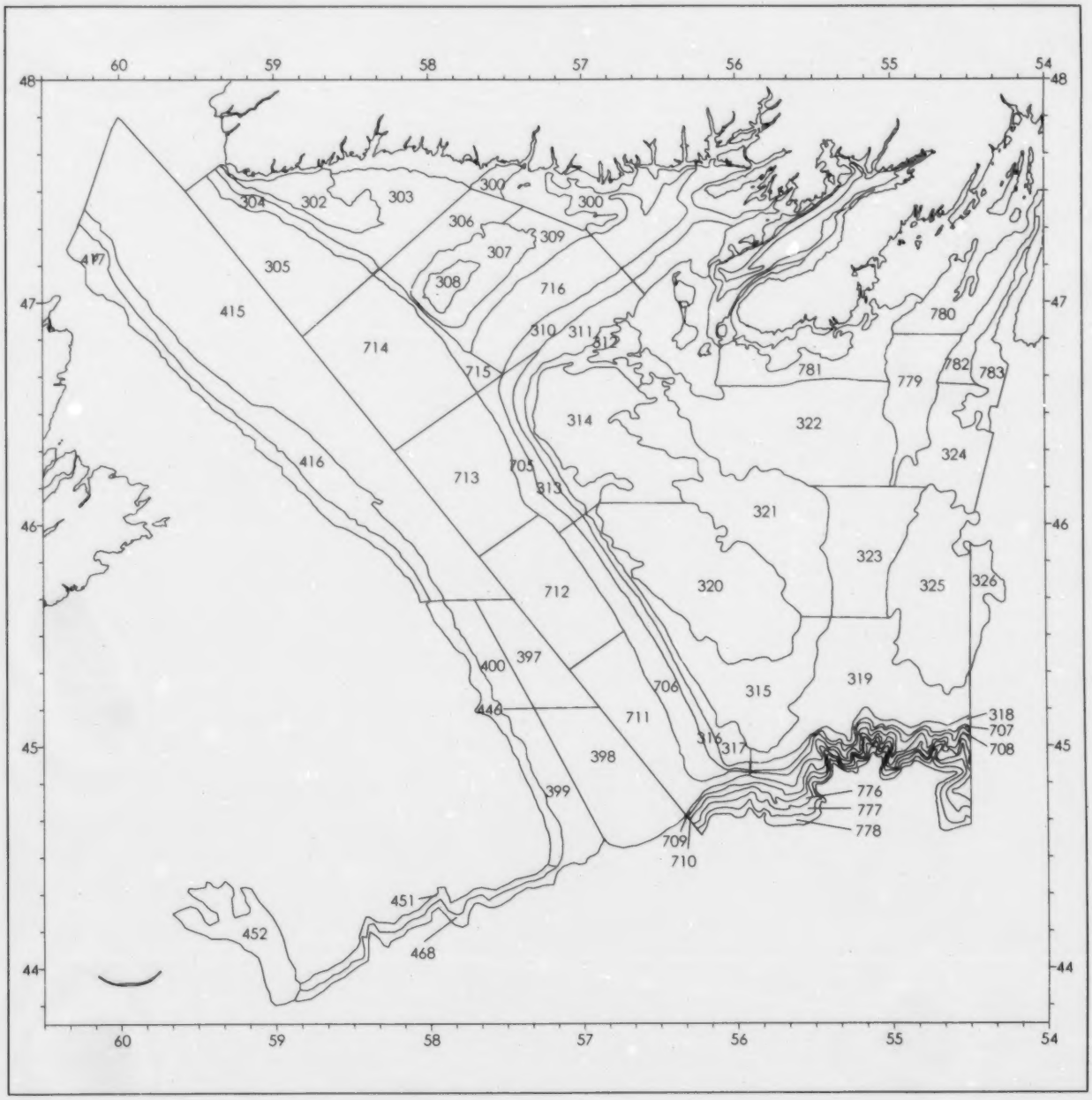
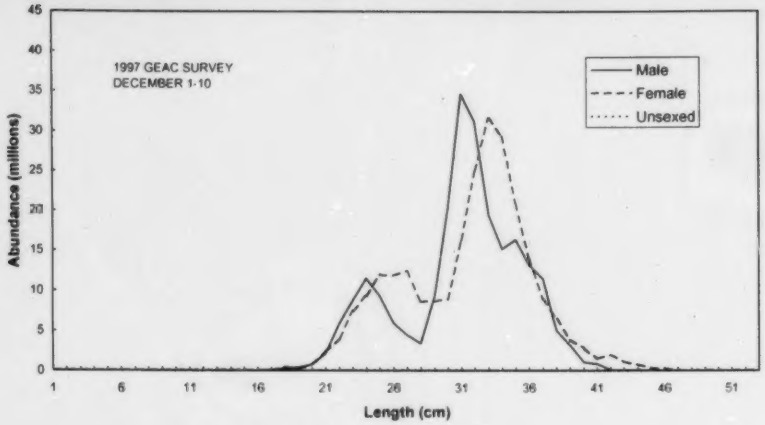
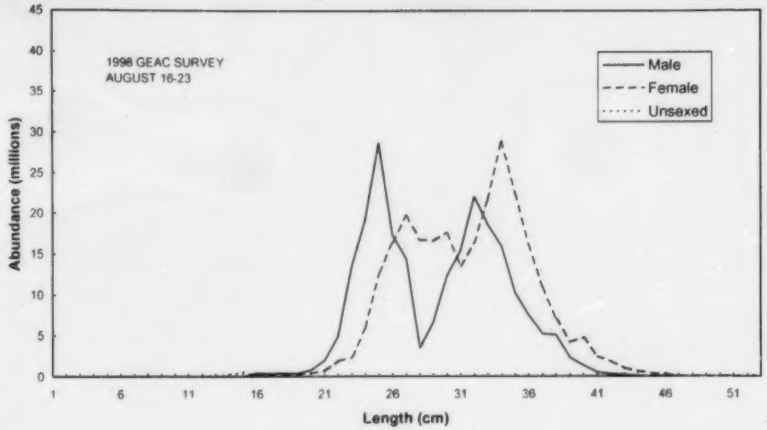
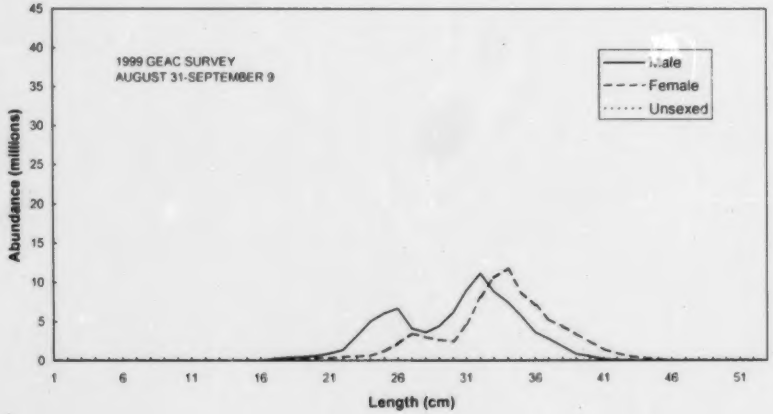
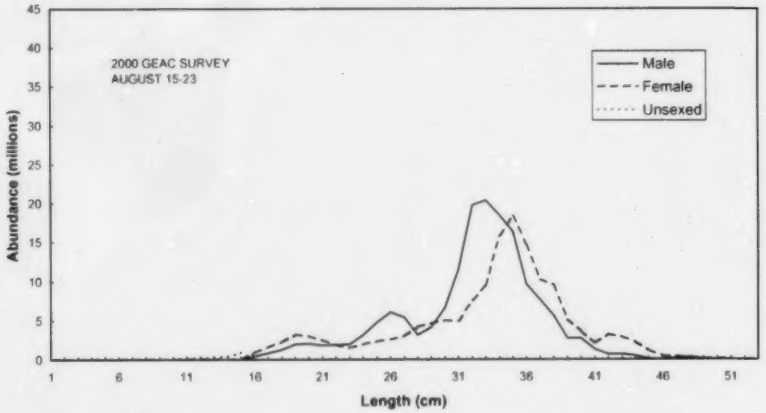


Figure 1a Stratum boundaries within Unit 2.
Numbered strata indicate those surveyed during summer GEAC survey of Unit 2.









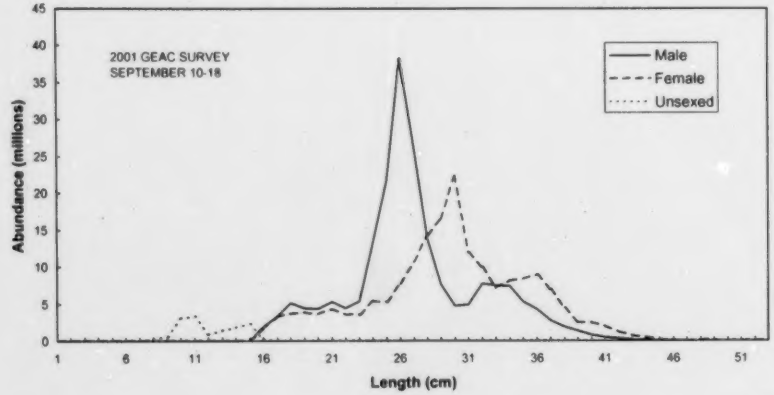


Figure 2 Redfish survey abundance index at length from GEAC Industry surveys of UNIT 2 from 1997-2001

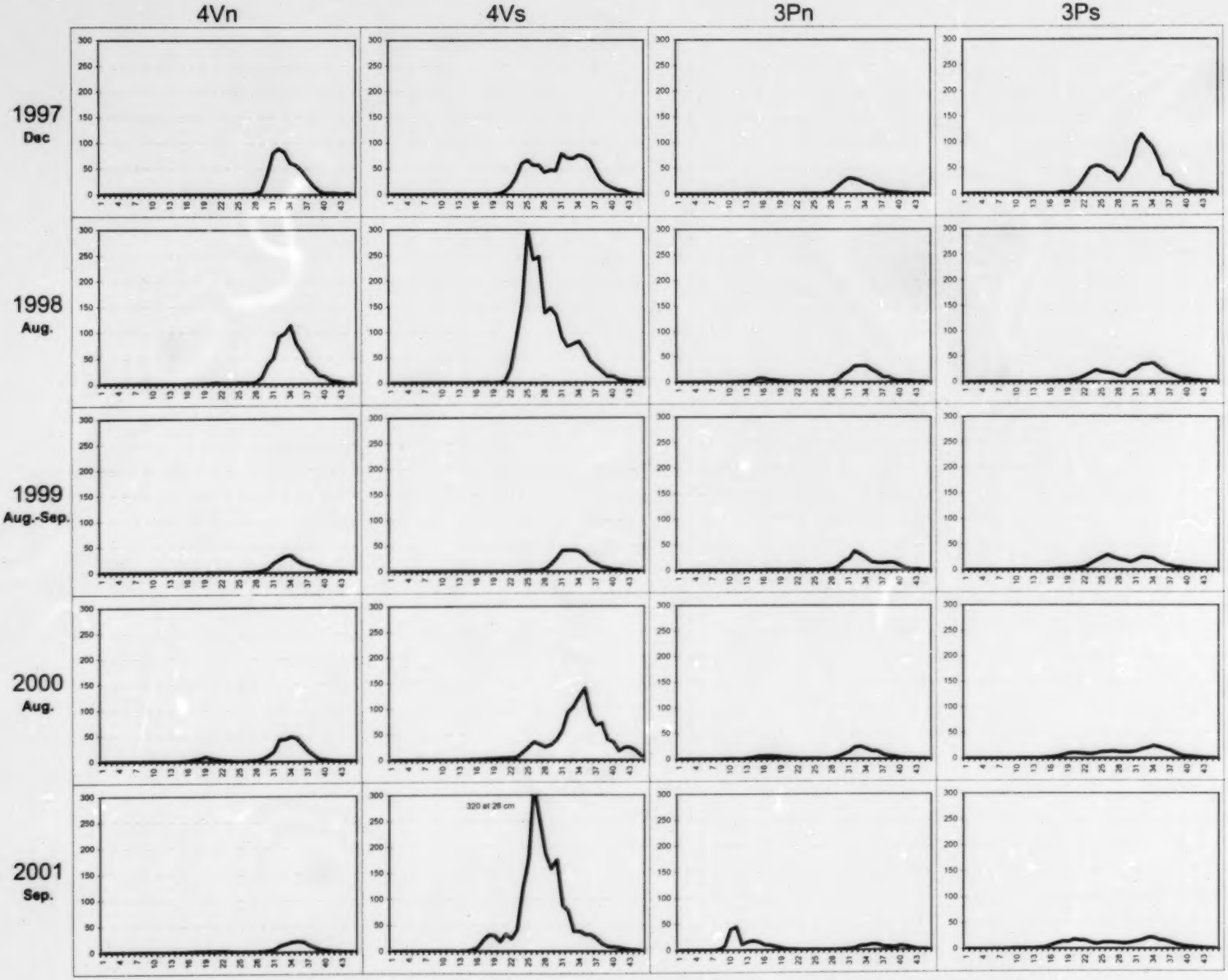


Figure 3 Length distributions from stratified-random GEAC industry surveys to UNIT2 for 1997-2001. Plotted are mean number per standard (1.75 n. mi.) tow. X-axis is forklength in centimetres. The 1997 and 1999-2000 surveys were conducted by the MV Cape Beaver and the 1998 and 2001 surveys by the MV Cape Ballard. All surveys utilized an Engel 170 trawl. The 2000 survey also utilized a liner.

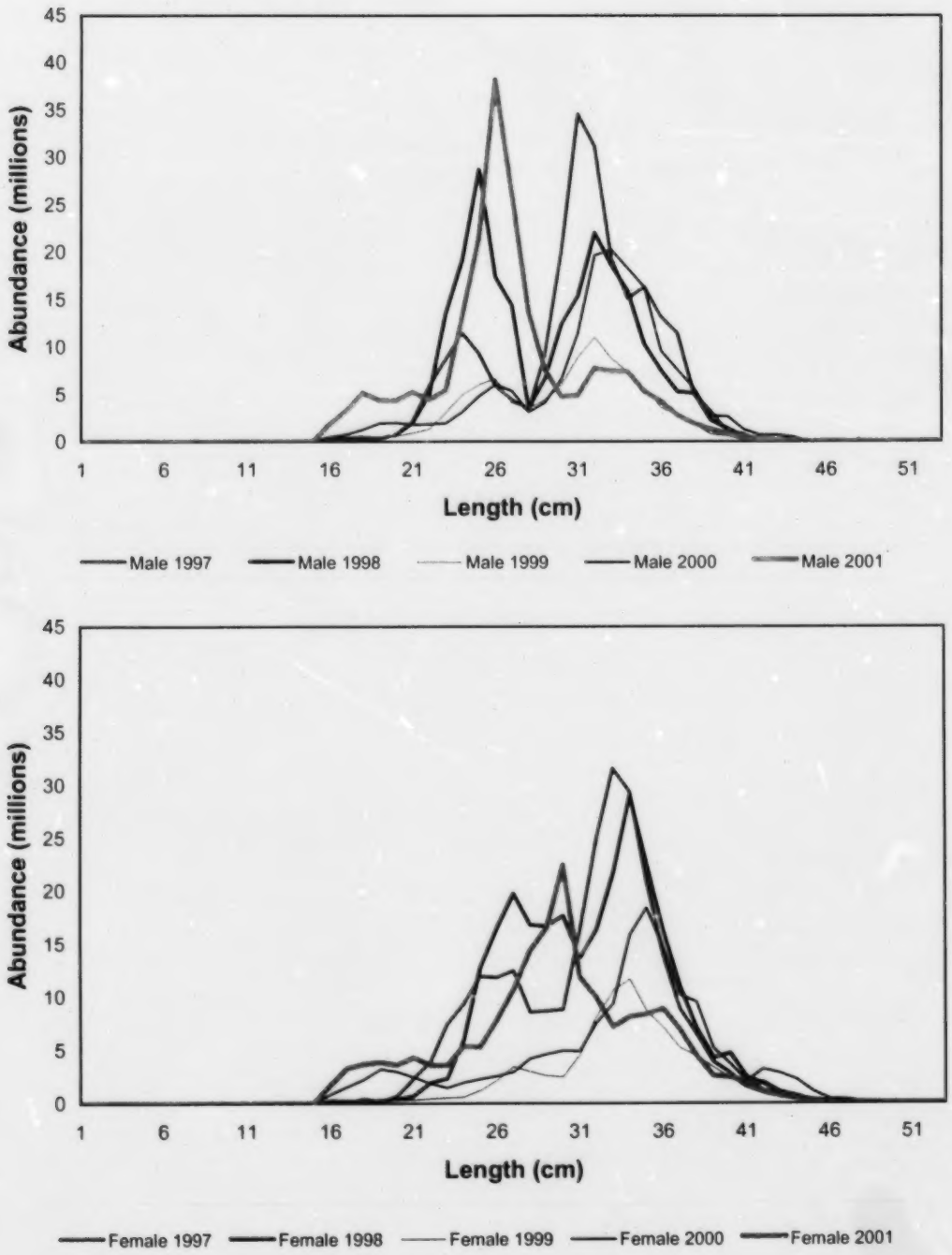


Figure 4 Redfish survey abundance index at length from GEAC Industry surveys of Unit2, 1997-2001. Distributions are shown for male and for female populations.

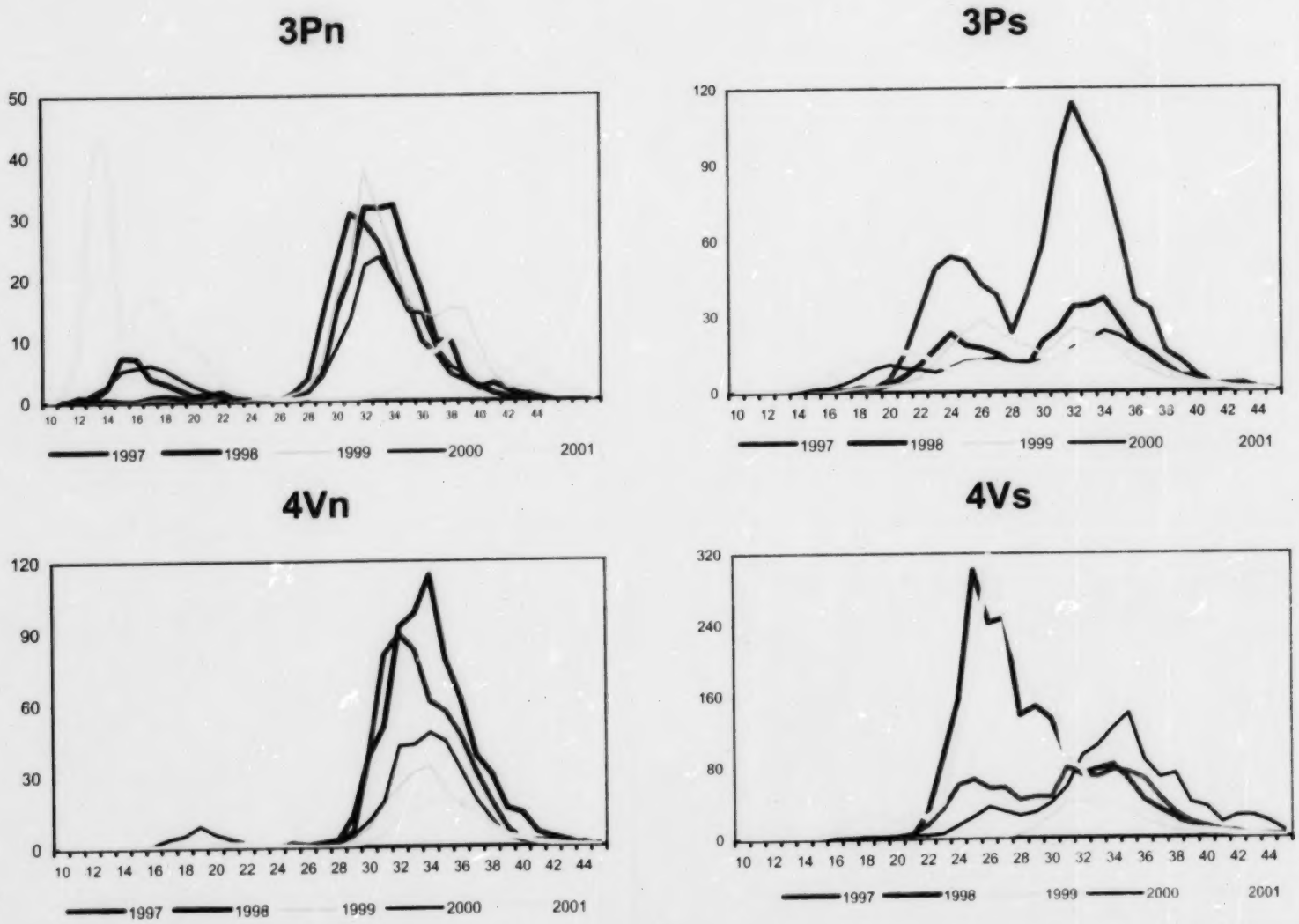


Figure 5 Length distributions as per Figure 3, showing 1997-2001, one panel for each division. Plotted are mean number per standard (1.75 n. mi.) tow. X-axis is forklength in centimetres. Note different y-axis scales.